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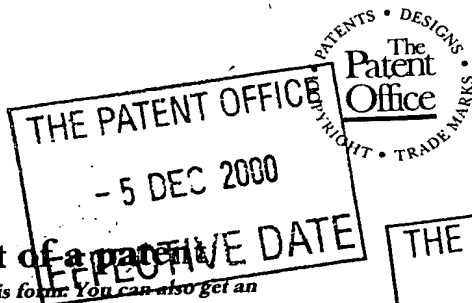
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1. Your reference	
2. Patent application number *(The Patent Office will fill in this part)*	0 2 DEC 2000 **0029571.7**
3. Full name, address and postcode of the or of each applicant *(underline all surnames)*	Hewlett-Packard Company 3000 Hanover Street Palo Alto CA 94304, USA
Patents ADP number *(if you know it)*	Delaware, USA 49658800l
If the applicant is a corporate body, give the country/state of its incorporation	
4. Title of the invention	Activation of voice-controlled apparatus
5. Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	Robert F Squibbs Hewlett-Packard Ltd, IP Section Filton Road Stoke Gifford Bristol BS34 8QZ 7563083 0 0 i
Patents ADP number *(if you know it)*	

	Country	Priority application number *(If you know it)*	Date of filing *(day / month / year)*
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* a) *any applicant named in part 3 is not an inventor, or* b) *there is an inventor who is not named as an applicant, or* c) *any named applicant is a corporate body.* *See note (d))*	Yes	

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Description   6

Claim(s)   2

Abstract   1

Drawing(s)   3 → 5

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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*

Request for preliminary examination and search *(Patents Form 9/77)*   1

Request for substantive examination *(Patents Form 10/77)*

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11.

I/We request the grant of a patent on the basis of this application.

Signature   *Π F Squibb*
Robert Francis Squibbs   Date   4 December 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

K Nommeots-Nomm   Tel: 0117-312-9947

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Activation of Voice-Controlled Apparatus

Field of the Invention

5   The present invention relates to the activation of voice-controlled apparatus.

Background of the Invention

Voice control of apparatus is becoming more common and there are now well developed technologies for speech recognition particularly in contexts that only require small

10   vocabularies.

However, a problem exists where there are multiple voice-controlled apparatus in close proximity since their vocabularies are likely to overlap giving rise to the possibility of several different pieces of apparatus responding to the same voice command.

15

It is known from US 5,991,726 to provide a proximity sensor on a piece of voice-controlled industrial machinery or equipment. Activation of the machinery or equipment by voice can only be effected if a person is standing nearby. However, pieces of industrial machinery or equipment of the type being considered are generally not closely packed so

20   that whilst the proximity sensor has the effect of making voice control specific to the item concerned in that context, the same would not be true for voice controlled kitchen appliances as in the latter case the detection zones of the proximity sensors are likely to overlap.

25   One way of overcoming the problem of voice control activating multiple pieces of apparatus, is to require each voice command to be immediately preceded by speaking the name of the specific apparatus it is wished to control so that only that apparatus takes notice of the following command. This approach is not, however, user friendly and users frequently forget to follow such a command protocol, particularly when in a hurry.

30

It is an object of the present invention to provide a more user-friendly way of minimising the risk of unwanted activation of multiple voice-controlled apparatus by the same verbal command.

5   **Summary of the Invention**

According to the present invention, there is provided a method of activating voice-controlled apparatus, comprising the steps of :

(a) - detecting when the user is looking towards the apparatus;

(b) - detecting when the user is speaking to the apparatus; and

10   (c) - enabling the apparatus for voice control only if steps (a) and (b) indicate that the user is simultaneously looking towards the apparatus and speaking to it.

The present invention also encompasses a system and apparatus embodying the foregoing method of the invention.

15

Brief Description of the Drawings

A method and system embodying the invention, for controlling activation of voice-controlled devices, will now be described, by way of non-limiting example, with reference

20   to the accompanying diagrammatic drawings, in which:

. **Figure 1**   is a diagram illustrating a room equipped with camera-equipped voice-controlled devices;

. **Figure 2**   is a diagram illustrating a camera-equipped room for controlling activation of voice-controlled devices in the room;

25   . **Figure 3**   is a diagram illustrating a room in which there is a user with a head-mounted camera arrangement for controlling activation of voice-controlled devices in the room; and

. **Figure 4**   is a diagram illustrating a room in which there is a user with a head-mounted infrared pointer for controlling activation of voice-controlled devices in the room.

30

Best Mode of Carrying Out the Invention

Figure 1 shows a work space 11 in which a user 10 is present. Within the space 11 are three voice-controlled devices 14 (hereinafter referred to as devices A, B and C respectively) each with different functionality but each provided with a similar user interface subsystem 15 permitting voice control of the device by the user.

More particularly, and with reference to device C, the user-interface subsystem comprises:
- a camera 20 feeding an image processing unit 16 that, when enabled, is operative to analyse the image provided by the camera to detect any human face in the image and determine whether the face image is a full frontal image indicating that the user is looking towards the camera and thus towards the device C. The visibility of both eyes can be used to determine whether the face image is a frontal one.
- a microphone 21 feeding a speech recognition unit 23 which, when enabled, is operative to recognise a small vocabulary of command words associated with the device and output corresponding command signals to a control block 26 for controlling the main functionality of the device itself (the control block can also receive input from other types of input controls such as mechanical switches so as to provide an alternative to the voice-controlled interface 15).
- a sound-detection unit 27 fed by microphone 21 which triggers activation of the image processing unit upon detecting a sound (this need not be a speech sound). Once triggered, the image processing unit will initiate and complete an analyse of the current image from camera 20.
- an activation control block 18 controlling activation of the speech recognition unit 23 in dependence on the output of the image processing unit 24; in particular, when the image processing unit indicates that the user is looking at the device, the block 18 enables the speech recognition unit.

Since the image processing unit 24 will take a finite time to analyse the camera image, a corresponding duration of the most recent output from the microphone is buffered so that what a user says when first looking towards the device is available to the speech recogniser when the latter is enabled as a consequence of the image processing unit producing a delayed indication that the user is looking towards the device. An alternative approach is to

have the image processing unit operating continually (that is, the element 27 is omitted) with the most recent image analysis always being used as input to the activation control.

5   If the user 10 just speaks without looking towards device C, the activation control block 25 keeps the speech recogniser 23 in an inhibited state and the latter therefore produces no output to the device control block 26. However, upon the user looking towards the camera 20 the image processing unit detects this and provides a corresponding indication to the activation control block 25. As a consequence, block 25 enables the speech recognition unit to receive and interpret voice commands from the user. This initial enablement only 10   exists whilst the image processing unit 24 continues to indicate that the user is looking towards the device. Only if the user speaks during this initial enablement phase does the activation control block 25 continue to enable the speech recognition unit 23 after the user looks away; for this purpose (and as indicated by arrow 28 in Figure 1), the block 25 is fed with an output from the speech recogniser that simply indicates whether or not the user is 15   speaking.

When the user stops talking, the block 25 continues to enable the speech recognition unit 23 for a limited further period (for example, 5 seconds) in case the user wishes to speak again to the device. If the user starts talking again in this period, the speech recogniser 20   interprets the input and also indicates to block 25 that the user is speaking again; in this case, block 25 continues its enablement of unit 23 and resets its timing out of the aforesaid limited period of silence allowed following speech cessation.

In this manner, the user can easily ensure that only one device at a time is responsive to 25   voice control.

Since a single camera has only a limited field of vision, various measures can be taken to increase the visual coverage provided. For example, the camera can be fitted with a wide-angle lens or with a scanning apparatus, or multiple cameras can be provided.

30

Figure 2 shows another embodiment which whilst operating in the same general manner as the Figure 1 arrangement for effecting activation control of voice-controlled devices 14,

utilises a set of four fixed room cameras 28 to determine when a user is looking at a particular device. These cameras feed image data via LAN 29 to a device activation manager 30 which incorporates an image processing unit 33 for determining when a user is looking at a particular device having regard to the direction of looking of the user and the

5   user's position relative to the device positions. When the unit 33 determines that the user is looking at a device 14 it informs a control block 34 which is responsible for informing the device concerned via an infrared link established between an IR transmitter 35 of the manager and an IR receiver 36 of the device. The manager 30 has an associated microphone 31 which, via sound activation control block 37, causes the image processing

10   unit to be activated only when a sound is heard in the room.

The devices themselves do not have a camera system or image processing means and rely on the manager 30 to inform them when they are being looked at by a user. Each device 14 does, however, include control functionality that initially only enables its speech

15   recognition unit whilst the user is looking at the device as indicated by manager 30, and then provided the user speaks during this initial enablement, maintains enablement of the speech recogniser whilst the speaking continues and for a timeout period thereafter (as for the Figure 1 embodiment) even if the user looks away from the device.

20   Figure 3 shows a further camera-based embodiment in which the voice-controlled devices 14 (only two shown) are of substantially the same form as in the Figure 2 embodiment, but the camera system is now a camera 51 mounted on a head mounting carried by the user and facing directly forwards to show what the user is facing towards. This camera forms part of user-carried equipment 50 that further comprises an image processing unit 53, control

25   block 54, and an infrared transmitter 35 for communicating with the devices 14 via their infrared receivers 36. The image from the camera 51 is fed to the image processing unit 53 where it is analysed to see if the user is facing towards a device 14. This analysis can be facilitated by providing each device with a distinctive visual symbol, preferably well lit. When the unit 53 determines that the user is facing a device it informs the control block 54

30   which is then responsible for notifying the corresponding device via the IR transmitter 35.

Figure 4 shows a simplified version of the Figure 3 embodiment in which the user-carried camera and image processing unit are replaced by a a directional transmitter (here shown as an IR transmitter 60) mounted on the user's head to point in the direction the user is facing. Now, whenever a device's IR receiver 36 picks up the transmissions from transmitter 60, it

5   knows the user is facing towards the device.

Many other variants are, of course, possible to the arrangement described above. For
10   example, even after its enablement, the speech recognizer of each device can be arranged to ignore voice input from the user unless, whilst the user is looking towards the apparatus, the user speaks a predetermined key word. In one implementation of this arrangement, after being enabled the speech recogniser is continually informed of when the user is looking towards the device and only provides an output when the key word is recognised (this
15   output can either be in respect only of words spoken subsequent to the key words or can take account of all words spoken after enablement of the recogniser (the words spoken prior to the key word having been temporarily stored).

The determination of when a user is looking towards a device can be effected by detecting
20   the position of the user in the space 11 by any suitable technology and using a direction sensor (for example, a magnetic flux compass or solid state gyroscope) mounted on a user's head for sensing the direction of facing of the user, the output of this sensor and the position of the user being passed to a processing unit which then determines whether the user is facing towards a device (in known positions).

CLAIMS

1. A method of activating voice-controlled apparatus, comprising the steps of :

(a) - detecting when the user is looking towards the apparatus;

(b) - detecting when the user is speaking to the apparatus; and

(c) - enabling the apparatus for voice control only if steps (a) and (b) indicate that the user is simultaneously looking towards the apparatus and speaking to it.

2. A method according to claim 1, wherein the apparatus, after being enabled for voice control, remains so enabled following cessation of step (a) only whilst step (b) is taking place and for a limited timeout period thereafter, recommencement of step (b) during this period continuing voice control with timing of the timeout period being reset.

3. A method according to claim 1, wherein the apparatus only remains enabled for voice control whilst step (a) is being effected.

4. A method according to any one of the preceding claims, wherein step (a) is effected using a camera system mounted on the apparatus, images produced by the camera system being processed to determine if the user is looking towards the apparatus.

5. A method according to any one of claims 1 to 3, wherein step (a) is effected using a camera system comprising one or more cameras mounted off the apparatus in fixed positions, images produced by the camera system being processed to determine if the user is looking towards the apparatus.

6. A method according to any one of claims 1 to 3, wherein step (a) is effected using a camera system mounted on a user's head and arranged to point in the direction the user is facing or looking, images produced by the camera system being processed to determine if the user is looking towards the apparatus.

7. A method according to any one of claims 1 to 3, wherein step (a) is effected using a directional transmitter mounted on a user's head and arranged to point in the direction the user is facing, the apparatus having a receiver for detecting emissions from the directional transmitter.

5

8. A method according to any one of claims 1 to 3, wherein step (a) is effected by detecting the position of the user and using a direction sensor mounted on a user's head for sensing the direction of facing of the user, the output of this sensor and the position of the user being used to determine whether the user is facing towards a known position of the

10 apparatus.

9. A method according to any one of the preceding claims, wherein speech recognition means of the apparatus ignores voice input from the user unless whilst the user is looking towards the apparatus, the user speaks a predetermined key word.

15

ABSTRACT

Activation of Voice-Controlled Apparatus

A method of activating voice-controlled apparatus (14) is provided which minimises the risk of activating more than one such apparatus at a time where multiple voice-controlled apparatus exist in close proximity. To activate the apparatus, a user (10) is required both to be looking at the apparatus (14) and speaking at the same time. The apparatus is then activated, preferably only whilst the speaking continues and for a limited period thereafter. Detection of whether the user is looking at the apparatus can be effected in a number of ways including by the use of camera systems (20,24), by a head-mounted directional transmitter, and by detecting the location and direction of facing of the user.

(Fig. 1)

Figure 1

Figure 2

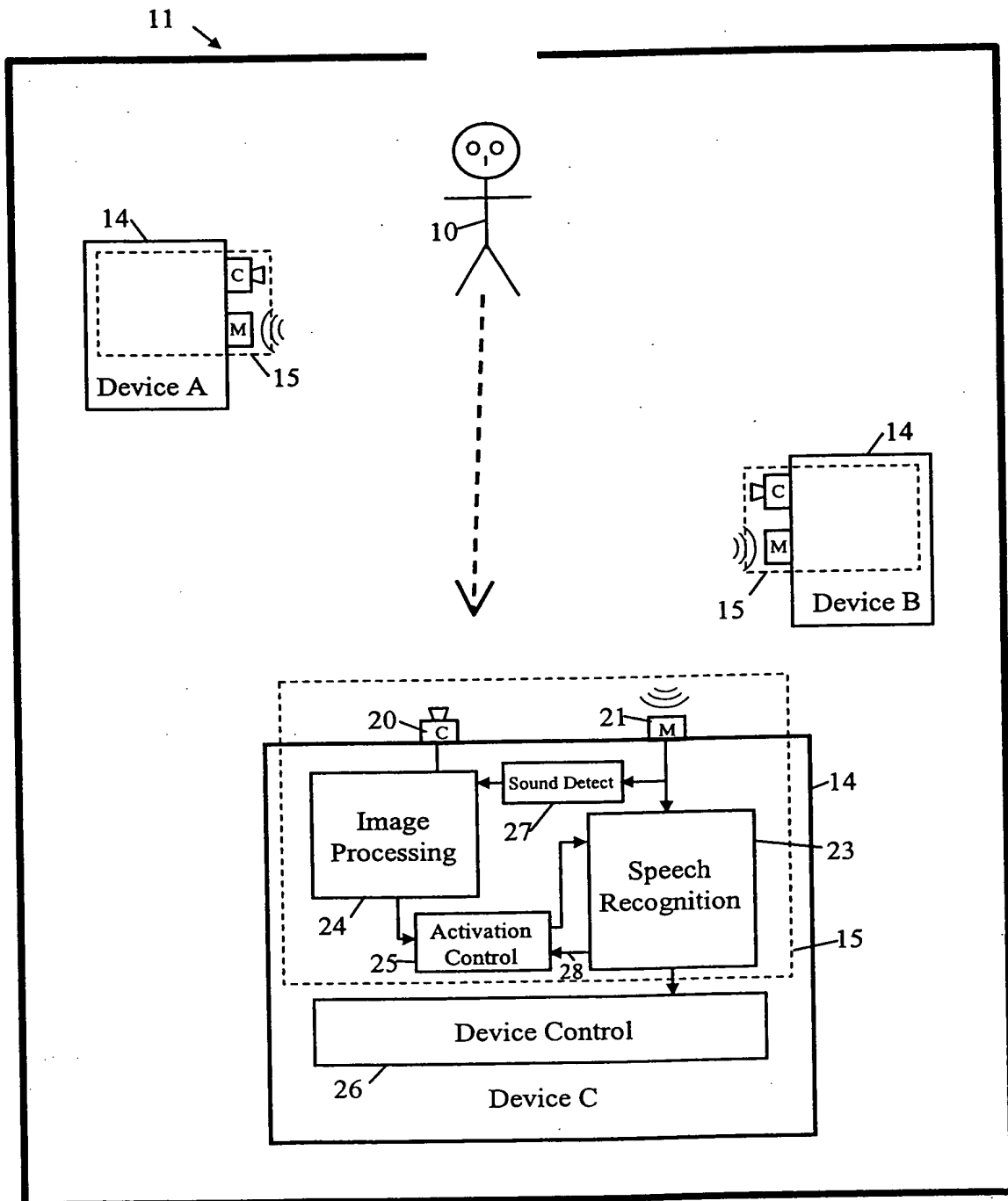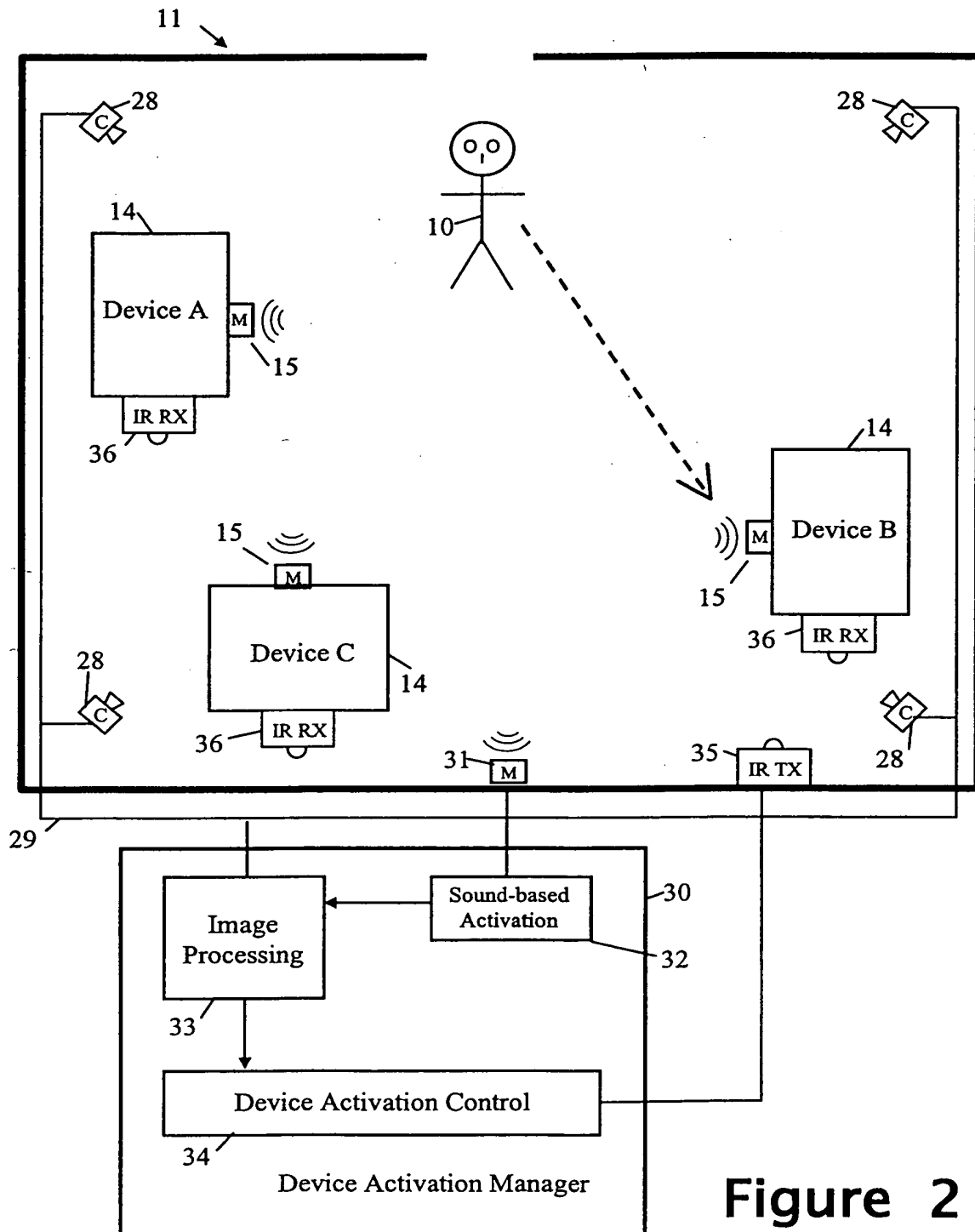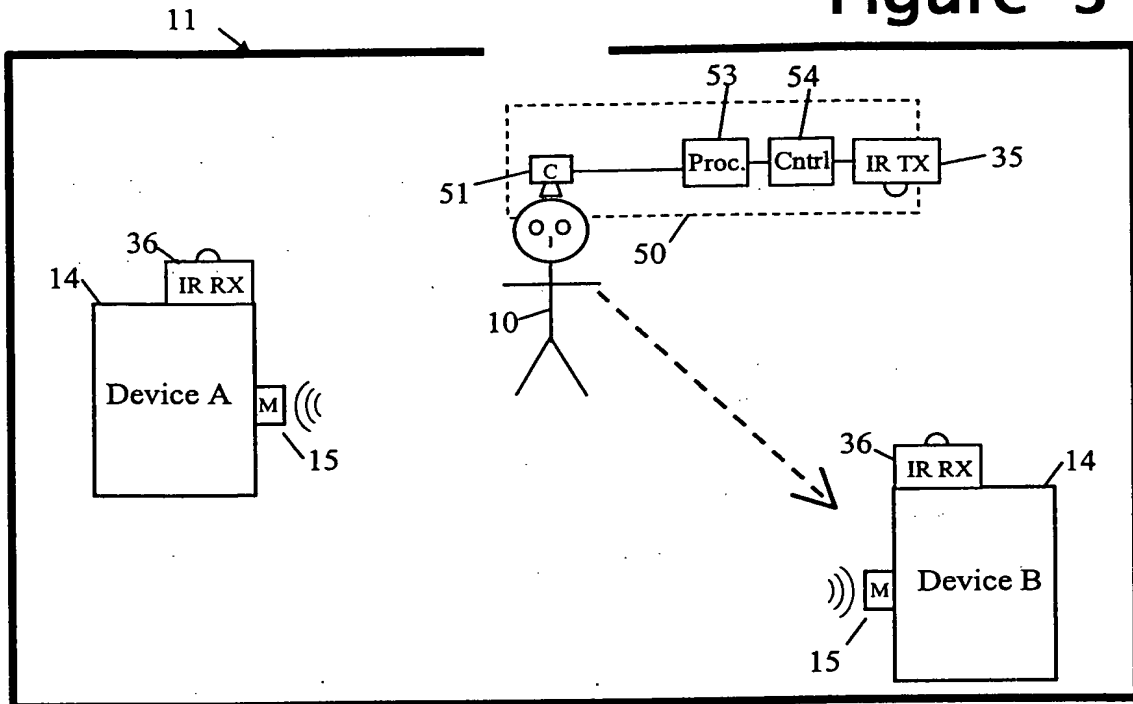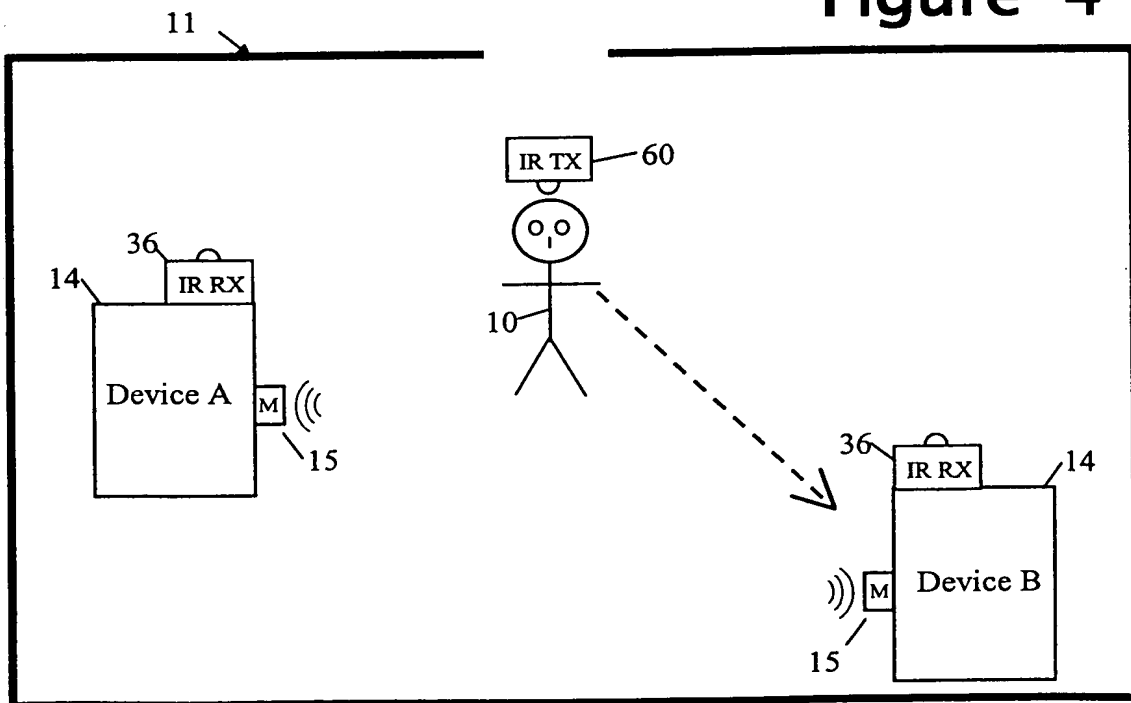THIS PAGE BLANK (USPTO)

Figure 3

Figure 4

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